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[FIFTH SERIES.]

“..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo.”
N. Parthenii Giannettasii Ecl. 1.

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I.—*On a Cysticercus from the Peritoneal Cavity of a Raccoon-like Dog (Nyctereutes procyonides).* By F. G. PENROSE.

[Plate II.]

IN the spring of 1878 the late Prof. Garrod, whilst dissecting “an adult male [of *Nyctereutes procyonides*] which died on the 2nd of February last, the father of a litter of six born on May 2nd, 1877,” discovered an enormous number of some parasitic form of worm in the peritoneal cavity. He asked me to cut sections of one, and from those sections wrote the following paragraph when describing some anatomical peculiarities of the dog in the P. Z. S. 1878, p. 376:—

“In the peritoneal cavity of the adult male *Nyctereutes* (which, like the half-grown female, had excessive atheroma of all its larger arteries) I found an immense number of parasitic worms, collected especially about the abdominal surface of the liver and the stomach. These worms had ‘heads’ much like those of the *Bothriocephali*, but larger. My friend Mr. F. G. Penrose has most kindly made sections of them, and has demonstrated the existence of a most peculiar cavity in each. This cavity is coiled up within the ovate ‘head;’ its lumen is small; and its walls are plicated very extensively, the magnitude as well as the number of the folds being great.

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It opens externally at its proximal extremity by one of its ends only. The 'body' is tænioid in its proportions, and is not segmented. It is about $2\frac{1}{2}$ inches in total length, the 'head' being about the size of a hemp-seed or a little smaller."

I also showed the sections to Prof. Lankester, who gave me several references; but I failed to make any thing out, and nothing more was done until Prof. Lankester saw a monograph on *Cysticercus*-forms by Dr. Monier of Lille. He immediately recognized that the worm I had cut was a *Cysticercus*. He lent me the monograph, of which the title is 'Travaux de l'Institut Zoologique de Lille et de la station maritime de Wimereux,' tome iii. fascicule i., "Essai Monographique sur les Cysticercques par R. Monier," and persuaded me to cut some more sections, with the view of ascertaining if this particular form had been described.

Dr. Monier has fairly completely worked out the history of the *Cysticercus*-larva (*C. pisiformis*) of *Tænia serrata*, and gives some beautiful figures.

He shows the early development in the liver of the rabbit, and describes a migration at the end of the first month into the peritoneal cavity. He then gives a description of a form soon after it has arrived in the peritoneal cavity. He shows how, at the time of leaving the liver, the young *Cysticerci* are at various stages of development, but that generally the cephalic rudiment of the future *Tænia* is already differentiated, and even that it was distinctly indicated on the twenty-second day after infection.

He describes how the rudiment is at first a simple depression surrounded by a thick bed of granular cells, then how the invagination increases and how at the same time there is cell-proliferation, that at the bottom of the invagination a slight dilatation forms, and at the same time an elevation rises slightly to one side of the line of axis of the invagination from the floor of this invagination, which is the origin of the head of the future *Tænia*.

He then describes the origin of the suckers and of the hooklets.

Embryos which he has just been describing have generally attained the length of more than a centimetre.

He then goes on to describe the histological details, and discusses the formation of the future vesicle.

The stage to which I have been referring is certainly less advanced than that of those I am going to discuss; and the next stage is also certainly more advanced. The two stages are illustrated at Pl. II. figs. 2 and 5.

He says that after arrival in the peritoneum the young animals soon become dropsical, and that it is then very difficult to tell their degree of development, and it is only to be done by sections.

I now propose to give a short account of my specimens, and to compare them with his two stages.

As will be seen from Prof. Garrod's description, they were present in immense numbers, lying loosely in the peritoneal cavity, although coiled and twisted amongst themselves, especially one heap in seemingly inextricable confusion lying between the liver and stomach.

Several were preserved for a few days in ordinary methylated spirit, and some of these were afterwards placed in absolute alcohol. Unfortunately no investigations were made whilst the animals were still alive and before reagents were applied. The method employed that gave the most satisfactory results was as follows:—Worm was imbedded in cacao-butter; a series of sections were cut; and these were stained on the slide with magenta; they were afterwards clarified by oil of cloves and mounted in Canada balsam.

Naked-eye characters.—If we divide them into an anterior swollen extremity and a posterior continuation or tail, then, with one exception (fig. 4), they all have the same general appearance about their anterior swollen extremity (*vide* figs. 1, 2, 3). This extremity is more or less ovoidal, covered by a smooth cuticle; and anteriorly there is a depression which is bounded by two prominent rounded lips; but there is no apparent difference of cuticle like that between mucous membrane and skin. This depression is the external orifice of a blind canal (*vide* fig. 5). Posteriorly this anterior swelling is continuous with the tail, there generally being some deep and well-marked furrows where the one passes into the other. The tail is extremely variable in all its dimensions.

In some the tail is very long: a total length of 4 inches was the longest I measured; but I do not know that that was the limit, as some of the specimens were so brittle that it was impossible to unravel the mass without breaking them. In others, on the other hand, the tail was reduced to a minimum, though not absent, the specimen being .2 inch.

The diameter of this tail varied not only in different specimens, but also in the same specimen, being at one part contracted in length and thickened, at others greatly attenuated (*vide* fig. 4)—this being solely due to the effect of the alcohol on the muscular fibres, though the tail was normally much longer in some specimens than in others: the thinnest tails were not necessarily the longest, and *vice versa*.

The cuticle of the tails and of the posterior part of the anterior extremities is thrown into a number of irregular transverse wrinkles. These have no relation with the segments of a *Tenia*, though sometimes curiously simulating them and, as Dr. Monier has shown, are due to the following cause:—

The tail consists of a central core enclosed within the muscular zone, which contains both circular and longitudinal fibres, the latter greatly predominating; and between this layer and the cuticle there is a loose, subcuticular, very actively growing connective layer of cells.

As the central core increases but slowly relatively to this outer layer, and is of a firmer tissue, supported and enclosed by the muscles, it necessarily follows that the cuticle will be thrown into folds by the rapid increase of the subcuticular layer.

At the posterior extremity of the tail there is generally, though not always, a slight depression (*vide* figs. 1, 2, 3), looking something like the one at the anterior extremity. It seems to have nothing to do with any internal canal, as Monier says that both he and Leuckart have searched in vain for any canal that opened externally there; and although I made several series of sections expressly to try and find one, I did not succeed. Monier observed that whilst the larval *C. pisiformes* were still in the liver of their host, on the twenty-second day after infection, several specimens, though not all, became constricted somewhere near their middle, and two semiequal portions were formed, connected by a twisted cord, each end of which fitted into a depression, the one at the posterior extremity of the anterior part, the other at the anterior extremity of the posterior part (*loc. cit.* chap. ii. p. 26, and pl. i. fig. 3). The posterior extremity was thrown off, and the anterior part retained simply the depression into which the cord fitted; but occasionally there was a short remnant of the connecting cord left in the form of a short tag.

In the present form I have never seen the tag. Although the shortest specimens almost invariably show the depression, it is equally well marked in some of the longest, though depressionless ones have perhaps a greater average length than the average of the whole number; but those without a depression are decidedly exceptional. So I do not think that the great difference in length is due to some not becoming constricted and retaining their whole original length whilst others have lost their posterior halves, both from what has been said above and also because between the shortest and longest there is a perfect gradation in length.

In the exception (fig. 4) mentioned above, the anterior

portion is much larger than in any other individual, is white and shiny, the others all being of a dull yellowish colour, and very irregularly swollen. It presents the usual anterior depression; but unfortunately this specimen was so brittle that, on cutting sections, the only point I succeeded in ascertaining was the presence of the regular canal. This swelling is most probably due to this individual specimen being more advanced in its development than the rest.

Monier has shown (*loc. cit.* p. 41) that soon after their emigration into the peritoneal cavity the *Cysticerci pisiformes* quickly become immensely swollen, owing to the collection of fluid; and he expressly states, with reference to pl. i. fig. 2 of his memoir, "Les cysticerques, à cet âge, sont généralement renflés à la partie où bourgeonne la tête."

On making a continuous series of longitudinal sections through the anterior extremity, one notices immediately that the depression mentioned above is the external orifice of a complicated canal terminating in a small blind extremity; and in those sections that pass through the middle of this cavity, almost at the extremity furthest from the orifice there is a small prominence histologically different from the plications of the wall of the canal. This is the rudiment of the future *Tenia*. It consists of a dense mass of deeply staining tissue, which appears to consist of fibres radiating from the apex, and which is continuous with the muscular tissue of the rest of the *Cysticercus* (fig. 5).

I have not been able to find any signs of hooklets; but there are four well-developed suckers (*vide* fig. 6) which lie out of the plane of a mesial section, but become visible in sections slightly away from that plane. They consist of a very dense striated tissue, are continuous with the cuticle lining the canal, and are often covered on both surfaces by black pigment-granules. They appear to have originated by a special modification of the cuticle. This cuticle lines the whole of the canal, and is continuous with the cuticle covering the animal externally.

The rest of the animal may be said to consist of three layers:—a central core composed of a cellulo-fibrous reticulum, many of the cells being strongly refracting, and known all through the Cestoids as calcareous corpuscles; this core is perforated in parts by vessels, which are particularly numerous in the tail, having a general longitudinal direction connected by transverse channels. The core is enclosed by a muscular zone, consisting for the most part of longitudinal fibres. This zone is very conspicuous in the tail, but becomes less important in the anterior extremity, though still

readily traceable; it is not a perfect layer, but contains many interstices between the fibres, through which the subcuticular cells are continuous with those of the core.

The subcuticular layer is composed of histological elements similar to those of the core, but is less dense. It is penetrated here and there by vessels, contains calcareous corpuscles, is continuous internally with the core through the muscular interstices, and is attached by fine fibres to the *cuticle*.

This form presents the following points of interest:—

1. The extreme variability in the length of the different specimens and the great absolute length (4 inches) of some of the longest specimens.

2. The slight prominence of the head of the future *Tenia*, accompanied by the complete differentiation of the suckers.

3. The probable absence of hooklets.

4. The presence of a larval form of *Tenia* in a dog.

Some of these facts might, I think, be accounted for if we assume that these larvæ have undergone their development in an unusual host. Prof. Huxley, in his paper on the Canidæ (P. Z. S. 1880, p. 262), speaks of *Canis procyonides* as living largely upon fruits and roots, and never attacking large animals, and as therefore not a purely carnivorous animal in the physiological, though it is in the morphological meaning of the term.

But I have ascertained that the individual during the three years and eight months of his life in the gardens used to be fed on fowl's heads and raw horseflesh. From the length of his residence in the Society's gardens we may, I think, fairly assume that he took in the ova during his sojourn here, and that therefore these *Cysticerci* are probably the larvæ of some common *Tenia*. The presence of suckers and probable absence of hooklets would point to the adult being one with those characters.

One naturally turns to *Tenia saginata*, Goeze, more commonly known in this country as *T. mediocanellata*, Kuchenmeister, as being the common hookless form also possessing pigmented suckers; and its identification with this form is strongly supported (1) by the small relative prominence of the origin of the head of the future *Tenia*, (2) by the absence of hooklets, and (3) by the pigmented appearance of the suckers; whilst against this the *Cysticercus* of *T. saginata* is only known to occur in ruminants, especially calves. And Monier believes on indirect evidence that the *Cysticerci* are never very numerous in the same host. He says (p. 58, *loc. cit.*) that "although this *Tenia* is much more frequent at Lille than *T. solium*, we have not been able to come across

its *Cysticercus*. It is true that we have not made a special search; but the veterinary surgeons and slaughterhouse-men have never observed it. One must conclude that this *Cysticercus* is never very abundant in the animals that it inhabits. One may, however, remark that the *Cysticercus* cannot be absolutely rare, since its *Tænia* is frequent. . . ."

He gives also, on pl. i. fig. 6, a drawing of this *Cysticercus* (of *T. saginata*), and refers to a fold, *p'*, near the external opening of the canal, which he found constant in the six or seven specimens he examined.

In my specimens, although there were suggestions of this fold, it was never so well marked as in his drawings, and was not unfrequently altogether absent.

EXPLANATION OF PLATE II.

Figs. 1-4. Enlarged views of the whole *Cysticercus*.

Fig. 5. Longitudinal section through anterior extremity, passing through the canal and the prominence of head of future *Tænia*.

Fig. 6. Prominence of head of future *Tænia*, showing suckers and absence of hooklets.

c = calcareous corpuscles; *h* = prominence of head of future *Tænia*; *m* = muscular fibres; *o* = opening at anterior extremity; *p*, posterior extremity, in most instances notched; *s* = sucker; *v* = vessels.

II.—On the Fructification of *Eusphenopteris tenella*, Brongn., and *Sphenopteris microcarpa*, Lesq. By ROBERT KIDSTON*.

[Plate I.]

I. *Eusphenopteris* (*Sphenopteris*) *tenella*, Brongn. (Pl. I. figs. 1-6.)

Histoire des Végétaux fossiles, pl. 49. fig. 1; Illustrations of Fossil Plants, pl. xxxix.†

The barren and fertile fronds of this fern are dissimilar; and were it not for their occurring in unusually favourable circumstances, it would be impossible to ascertain that these two forms of fronds belong to the same species. I have found no fern associated with *Eusphenopteris tenella*, with the exception

* Communicated by the Author, having been read before the Royal Physical Society, Edinburgh, April 19, 1882.

† Edited by G. A. Lebour, 1877.